

We claim:

1. A carvable mill blank for making a dental prosthetic comprising
 - a) a polymeric resin and
 - b) a filler,
- 5 wherein the blank is substantially free of cracks and fabricated such that the blank passes a Thermal Shock Test.
- 10 2. The blank of claim 1 wherein the blank is substantially free of discontinuities in the material that are larger than about 1 millimeter.
- 15 3. The blank of claim 1 wherein the blank is substantially free of discontinuities in the material that are larger than about 0.1 millimeter.
- 20 4. The blank of claim 1 wherein the blank is substantially free of discontinuities in the material that are larger than about 0.01 millimeter.
- 25 5. The blank of claim 1 wherein the blank further comprises a fluoride releasing material.
6. The blank of claim 1 wherein the polymeric resin is made from a material comprising a free radically curable monomer, oligomer or polymer.
7. The blank of claim 1 wherein the polymeric resin is made from a material comprising a cationically curable monomer, oligomer or polymer.
8. The blank of claim 1 wherein the polymeric resin is made from a material comprising a free radically curable monomer, oligomer or polymer and cationically curable monomer, oligomer or polymer.
- 30 9. The blank of claim 6 wherein the material is selected from the group consisting of 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy)phenyl]propane (bisGMA), triethyleneglycol dimethacrylate (TEGDMA), 2,2-bis[4-(2-

methacryloyloxyethoxy)-phenyl] propane (bisEMA), 2-hydroxy ethyl methacrylate (HEMA), urethane dimethacrylate (UDMA) and any combinations thereof.

- 5 10. The blank of claim 7 wherein the material is selected from the group consisting of diglycidyl ether of bisphenol A, 3,4-epoxycyclohexylmethyl-3-4-epoxy cyclohexene carboxylate, bisphenol F epoxides, and polytetrahydrofuran.
- 10 11. The blank of claim 1 wherein the resin is made from a material comprising a monomer, oligomer or polymer comprising both a free radically curable functionality and a cationically curable functionality.
- 15 12. The blank of claim 1 wherein the filler is selected from the group consisting of barium glass, quartz and zirconia silica.
13. The blank of claim 1 wherein the filler is derived from a sol-gel process.
14. The blank of claim 1 wherein the blank is capable of being further hardened after or during milling by a curing process.
- 20 15. A carvable mill blank for making a dental prosthetic comprising
- a) a resin component and
 - b) a fluoride releasing component
- 25 16. A method of making the dental mill blank of claim 1 comprising the steps of
- a) mixing a paste comprising a resin and a filler,
 - b) shaping the paste into a desired configuration,
 - c) minimizing material discontinuities from the paste
 - d) curing the paste into a blank, and
 - 30 e) relieving internal stresses in the blank.

17. The method in claim 16 wherein shaping the paste is performed using a mold and further comprising the steps of

- f) trimming excess paste material from the mold, and
- g) removing the cured paste from the mold.

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18. The method in claim 16 further comprising the step of

- f) mounting a handle to the cured paste.

19. The method in claim 16 wherein the curing system is selected from the group consisting of heat, light, microwave, e-beam and chemical cure.

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20. The method in claim 16 wherein the stress relieving step comprises slowly heating the cured paste in an oven temperature of at or above T_g of the resin.

21. A method of making the dental mill blank of claim 1 comprising the steps of

- a) mixing a paste comprising a resin and a filler,
- b) shaping the paste into a desired configuration,
- c) minimizing material discontinuities from the paste
- d) slow curing the paste on a light box for a sufficient time to effectuate low stress cure, such that the cured paste passes a Thermal Shock Test.

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22. A method of making a dental prosthetic comprising the steps of

- a) mixing a paste comprising a resin and a filler,
 - b) shaping the paste into a desired blank configuration,
 - c) minimizing material discontinuities from the paste,
 - d) curing the paste into a blank,
 - e) carving the blank into a desired shape and morphology,
- wherein the blank is substantially free of cracks and fabricated such that the blank passes a Thermal Shock Test.

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23. The method of claim 22 further comprising the step of:

- f) adding additional material to the carved blank.

24. The method of claim 22 further comprising the step of:

f) attaching the carved blank to tooth or bone structure.

5 25. The method of claim 22 further comprising the steps of:

f) manually changing the morphology of the carved blank and

g) finishing the outer surface of the carved blank.

10 26. The method of claim 22 wherein an intermediate step between curing and carving the paste comprises attaching a handle to the cured paste and wherein the carving is performed by a milling machine.

15 27. The method of claim 22 wherein the carving step is performed by a hand-held instrument.

20 28. The mill blank in claim 1 wherein the wherein the mill blank has a Barcol Hardness value greater than about 0% of the Barcol Hardness of a Standard Fumed Silica Mill Blank, and a Cuttability value greater than about 30% of the Cuttability value of a Standard Fumed Silica Mill Blank.

25 29. The mill blank in claim 1 wherein the mill blank has a Barcol Hardness value greater than about 5% of the Barcol Hardness of a Standard Fumed Silica Mill Blank.

30 30. The mill blank in claim 1 wherein the mill blank a Barcol Hardness value greater than about 15% of the Barcol Hardness of a Standard Fumed Silica Mill Blank.

35 31. The mill blank in claim 1 wherein the mill blank has a Cuttability value greater than about 50% of the Cuttability of a Standard Fumed Silica Mill Blank

32. The mill blank in claim 1 wherein the mill blank has a Cuttability value greater than about 100% of the Cuttability of a Standard Fumed Silica Mill Blank.

5 33. The mill blank in claim 1 wherein the filler is at least about 50% by weight of the total weight of the mill blank.

34. The mill blank in claim 1 wherein the filler is at least about 65% by weight of the total weight of the mill blank.

10 35. The mill blank in claim 1 wherein the filler is at least about 80% by weight of the total weight of the mill blank.

36. A method of making a dental mill blank suitable for the oral environment comprising:

- mixing a paste comprising a resin and a filler,
- shaping the paste into a desired configuration,
- minimizing material discontinuities from the paste,
- curing the paste into a blank, and

heating the blank to a temperature at or above the T_g of the resin for a time sufficient to relieve internal stresses in the blank, wherein the cured mill blank, when immersed in liquid nitrogen for about two minutes, does not explode and no cracks are observed upon visual inspection.

37. The method of claim 36 wherein the heating comprises heating the blank in an oven, and wherein the oven temperature is increased at a rate of no more than about 5°C per minute.

38. The method of claim 36 wherein the blank is substantially free of discontinuities that are larger than about 1 millimeter.

39. The method of claim 36 wherein the blank is substantially free of discontinuities that are larger than about 0.1 millimeter.

40. The method of claim 36 wherein the blank is substantially free of discontinuities that are larger than about 0.01 millimeter.

41. The method of claim 36 further comprising adding a fluoride releasing material to the paste.

42. The method of claim 36 wherein the polymeric resin is made from a material comprising a free radically curable monomer, oligomer, or polymer.

43. The method of claim 42 wherein the material is selected from the group consisting of 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy)phenyl]propane

(bisGMA), triethyleneglycol dimethacrylate (TEGDMA), 2,2-bis[4-(2-methacryloyloxyethoxy)-phenyl] propane (bisEMA), 2-hydroxy ethyl methacrylate (HEMA), urethane dimethacrylate (UDMA), and any combinations thereof.

44. The method of claim 36 wherein the polymeric resin is made from a material comprising a cationically curable monomer, oligomer, or polymer.

45. The method of claim 44 wherein the material is selected from the group consisting of diglycidyl ether of bisphenol A, 3,4-epoxycyclohexylmethyl-3-4-epoxy cyclohexene carboxylate, bisphenol F epoxides, and polytetrahydrofuran.

46. The method of claim 36 wherein the polymeric resin is made from a material comprising a free radically curable monomer, oligomer, or polymer and a cationically curable monomer, oligomer, or polymer.

47. The method of claim 36 wherein the resin is made from a material comprising a monomer, oligomer, or polymer comprising both a free radically curable functionality and a cationically curable functionality.

48. The method of claim 36 wherein the filler is selected from the group consisting of barium glass, quartz, and zirconia-silica.

49. The method of claim 36 wherein the filler is derived from a sol-gel process.

50. The method of claim 36 wherein the blank is capable of being further hardened by an additional curing process.

51. The method of claim 36 wherein shaping the paste is performed using a mold, the method further comprising:

trimming excess paste material from the mold, and
removing the cured paste from the mold.

52. The method of claim 36 further comprising mounting a handle to the cured paste.

53. The method of claim 36 wherein the curing system is selected from the group consisting of heat, light, microwave, e-beam, and chemical cure.

54. A method of making a dental mill blank suitable for the oral environment comprising:

mixing a paste comprising a resin and a filler,
shaping the paste into a desired configuration,
minimizing material discontinuities from the paste, and
light-curing the paste into a blank for a sufficient time to effectuate a low stress cure, wherein the cured mill blank, when immersed in liquid nitrogen for about two minutes, does not explode and no cracks are observed upon visual inspection.

55. The method of claim 54 wherein the light-curing occurs over a period of at least about 24 hours.

56. The method of claim 54 wherein the mill blank has a Barcol hardness value greater than or equal to the Barcol hardness of a standard fumed silica mill blank, and a cuttability value at least about 30% greater than the cuttability of a standard fumed silica mill blank.

57. The method of claim 54 wherein the mill blank has a Barcol hardness value at least about 5% greater than the Barcol hardness of a standard fumed silica mill blank.

58. The method of claim 54 wherein the mill blank has a Barcol hardness value at least about 15% greater than the Barcol hardness of a standard fumed silica mill blank.

59. The method of claim 54 wherein the mill blank has a cuttability value at least about 50% greater than the cuttability of a standard fumed silica mill blank.
60. The method of claim 54 wherein the mill blank has a cuttability value at least about 100% greater than the cuttability of a standard fumed silica mill blank.
61. The method of claim 54 wherein the filler is at least about 50% by weight of the total weight of the mill blank.
62. The method of claim 54 wherein the filler is at least about 65% by weight of the total weight of the mill blank.
63. The method of claim 54 wherein the filler is at least about 80% by weight of the total weight of the mill blank.
64. A method of making a dental prosthetic comprising:
mixing a paste comprising a resin and a filler,
shaping the paste into a desired blank configuration,
minimizing material discontinuities from the paste,
curing the paste into a blank,
heating the blank to a temperature at or above the T_g of the resin for a time sufficient to relieve internal stresses in the blank, and
carving the blank into a desired shape and morphology, wherein the blank is substantially free of cracks and when immersed in liquid nitrogen for about two minutes, does not explode and no cracks are observed upon visual inspection.
65. The method of claim 64 wherein the heating comprises heating the blank in an oven, and wherein the oven temperature is increased at a rate of no more than about 5°C per minute.

66. The method of claim 64 further comprising adding additional material to the carved blank.

67. The method of claim 64 further comprising attaching the carved blank to tooth or bone structure.

68. The method of claim 64 further comprising:
manually changing the morphology of the carved blank, and
finishing the outer surface of the carved blank.

69. The method of claim 64 further comprising attaching a handle to the cured paste after curing and before carving, wherein the carving is performed by a milling machine.

70. The method of claim 64 wherein the carving is performed by a hand-held instrument.

71. A method of making a dental prosthetic suitable for the oral environment comprising:

mixing a paste comprising a resin and a filler,
shaping the paste into a desired configuration,
minimizing material discontinuities from the paste,
light-curing the paste into a blank for a sufficient time to effectuate a low stress cure, and
carving the blank into a desired shape and morphology, wherein the cured mill blank, when immersed in liquid nitrogen for about two minutes, does not explode and no cracks are observed upon visual inspection.

72. The method of claim 71 wherein the light-curing occurs over a period of at least about 24 hours.